

AIR FORCE MATERIEL COMMAND

# LEADING EDGE

June 2000



## Modeling and Simulation

## Cover stories



*Photo is computational fluid dynamics of F-22 at Arnold Air Force Base, Tenn. Digital imaging by 1st Lt CK Keegan.*

## 4 -16 Modeling and Simulation

**A**ir Force Materiel Command has an extensive capability in a wide range of modeling and simulation — our product centers, logistics centers, test centers and Air Force Research Laboratory are all exploring ways to apply M & S to their missions.

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## TEST AND EVALUATION

## Joint exercise supports national defense

EGLIN AIR FORCE BASE, Fla. — U.S. Navy aircrews flew combat training missions from a carrier battle group in the Gulf of Mexico on Range C-52 at the Air Armament Center, Eglin Air Force Base, Fla., in early April.

The Navy took advantage of Eglin's range resources to fly day and night missions, during which aircrews dropped both inert and live ordnance, in order to certify the battle group before worldwide deployment.

"Eglin exists to support the national defense of the United States, and these training missions helped prepare naval aircrews for potential combat sorties in deployed areas around the globe," said Maj. Gen. Michael Kostelnik, Eglin commander.

Eglin has many advantages in hosting the Navy's training. "Joint operations are America's military future," said Gen. Kostelnik. "Only units and bases that can cooperate with other services will have a viable future in the U.S. military."

The training missions caused some increased noise for people living in Bluewater Bay and surrounding areas. However, Eglin personnel took steps to mitigate and monitor the noise impacts to local communities, beginning with an environmental assessment analyzing any potential environmental impacts of the training.

The 46th Weather Squadron ran a noise-contour model in advance of the live-bomb drops, allowing planners the flexibility to cancel or re-schedule missions when weather could cause sound levels to exceed standards for populated areas.

Next, Eglin's bioenvironmental engineering flight placed noise-monitoring devices at various locations during training missions. Collected data will provide valuable information to make Eglin's noise models more accurate and help minimize potential problem areas.

Eglin and Navy officials are exploring the feasibility of placing permanent noise monitoring equipment around the range to help evaluate noise effects of continued training exercises.

While Eglin is taking steps to mitigate potential community noise impacts, leaders have made it clear that the many benefits of the Navy training outweigh any potential problems. Discussions for future Navy training at Eglin are underway.

— 2nd Lt. Craig Goolsby, AAC Public Affairs

## PRODUCT SUPPORT

## Tinker to manage CALCM Penetrator AGM-86D

TINKER AFB, Okla. — Tinker Air Force Base and the cruise missile product group manages 50 new conventional air launched cruise missiles

(CALCM) equipped with an advanced unitary penetrator warhead specifically designed to defeat hard and deeply buried targets. This latest version of the highly successful CALCM is specifically designed to defeat hard and deeply buried targets.

The new CALCM Penetrator, AGM-86D, will give the warfighter the first stand-off penetration capability. Production of the missile begins in September with deliveries scheduled late February or early March 2001.

"Through analysis and testing, we are confident that the AGM-86D will meet or exceed all of the warfighter's written requirements for a hard and deeply buried target capability," said Col. Dave Kelly, product group manager, cruise missile product group division.

"The stand-off capability that the 86D provides will allow us to hold quite a number of potential targets at risk from a distance greater than 500 miles," said Col. Kelly.

The conventional air-launched cruise missiles will also be equipped with the new precision guidance system, critical for the warhead to destroy its target.

On Nov. 2, the first of 322 blast-frag warhead Cruise and air launched cruise missiles rolled off the production line to replenish a significantly reduced inventory.

At the same time, an improved global positioning system capability was added. The last 50 of this original replenishment order are those being converted to the penetrator.

— Ms. Gail Kulhavy, OC-ALC



Mr. Kevin Robertson, AFFTC

**EDWARDS AIR FORCE BASE, Calif. — On a rare rainy day in the Mojave Desert, the F-22 Combined Test Force (CTF) puts Raptor 4001 through wet-runway testing at 30, 60 and 90 knots. Later this year, the F-22 CTF will begin pushing the flight test envelope with Raptor 4003 and perform advanced avionics testing with Raptor 4004. (AFPN)**

# Modeling and Simulation use in AFMC

## — *New vector for Air Force*

— Col. Dennis W. Kirlin

Chief, Modernization Planning Division  
Directorate of Requirements  
HQ Air Force Materiel Command

**M**odeling and simulation (M&S) has been used for centuries for military purposes. Chess, the modeling and simulation of battle, was an early form of our modern war gaming.

Simulators have a long history in training operators and maintainers. Models have been used widely in design, test and evaluation. Acquisition decisions involving complex trade offs have been informed by M&S efforts.

Building on this rich heritage, AFMC has an extensive capability in a wide range of M&S. Our product centers, logistics centers, test centers and Air Force Research Laboratories are all exploring ways to apply M&S to their various missions.

The challenge for AFMC is to marshal and integrate this capability so that it is a vital part of how we become even more effective and efficient in supporting the warfighting commands.

### New vector

The Air Force corporate commitment to M&S was revitalized in 1993 with the Air Force's first "four-star" Summit on M&S. Following this summit, in June 1995 Air Force senior leadership, led by the Secretary and Chief of Staff Gen. Ronald Fogleman, gathered to craft a landmark strategy statement entitled "A New Vector for Air Force Modeling and Simulation."

This new vector would expand Air Force use of M&S to "improve readiness and reduce costs" and allow the Air Force to better "demonstrate the flexibility, responsiveness and utility of air power in peace and war."

The Air Force uses M&S for two basic reasons. First, M&S would be used for analysis — making better

decisions regarding research, acquisition, test, force structure and logistics.

Second, M&S used for training — developing better skills in weapon system operations, mission planning, rehearsal and command and control will be enhanced.

### Key elements

New vector was built on four key elements: vision, processes, people and infrastructure. The articles in this issue describe numerous command initiatives that seek to evolve our processes, people and infrastructure toward the new vector vision.

Our command initiatives generally support four areas: wargaming; test and evaluation; acquisition; and training. Wargames and exercises employ M&S to simulate activities that would be too costly, or impractical, using actual people and equipment.

### Tactics

With today's rapidly advancing technology, the increased sophistication and realism of simulations have helped develop new tactics and employment concepts for weapon systems. Test and evaluation has been enhanced when M&S is used in conjunction with actual testing to improve overall effectiveness and efficiency of development and operational test efforts.

Acquisition has benefited by enabling the evaluation of many different options without the necessity of building each of them. M&S allows for a greater breadth and depth of analysis for complex acquisition decisions.

Training is being revolutionized utilizing new technologies to enhance realism and sophistication in the training environment, and we now have distributed training concepts being employed. Training facilities need not

be duplicated at all training locations now that geographically dispersed locations can share training capabilities.

To accomplish the broad range of tasks associated with M&S support to wargaming, test and evaluation, acquisition and training, AFMC combines constructive, virtual and live elements into M&S environments as needed.

Constructive M&S describes efforts that are essentially computer-hosted with the results interpreted by analysts. For example, constructive M&S can provide critical information on how survivable a particular manned aircraft design would be in a hostile environment. Virtual M&S provides even better information since virtual M&S "links" a real pilot into the simulated environment and allows for tactics evaluations.

Finally, a live element can be introduced by having a real aircraft in flight linked with constructive and virtual elements allowing for a virtual operator to interact with a flying element.

This integration of constructive, virtual and live M&S elements is tailored to the task at hand and can be linked within, and across, our aeronautical, space and missiles, air armament and command, control and intelligence systems.

### AF Instruction

On a closing note, it should be highlighted that the Air Force recently published the first in a series of M&S Air Force Instructions. Air Force Instruction 16-1002 "Modeling and Simulation Support to Acquisition" describes how master planning combines with program-level and Air Force corporate-level M&S contributions to create an environment where we share and reuse M&S resources.

This policy underpins our future simulation-based acquisition efforts. AFMC is at the heart of this M&S revolution. The articles in this issue are a testimony to our expertise in this area. Even more importantly they show the tremendous potential M&S holds for increased acquisition and sustainment excellence into the future.

# Redefining the nature of defense acquisition

When the Simulation and Analysis Facility (SIMAF) opened its doors at Wright-Patterson Air Force Base, Ohio, cyberspace wargaming and the art and science of defense aerospace acquisition were propelled into the 21st century. The \$7 million facility gives Aeronautical Systems Center defense acquisition professionals a “real-time” ability to use computer models and simulation to design and test airplanes of the future in cyberspace, well before money is expended and metal is bent.

## Meeting Goals

“We’re meeting or exceeding all goals and objectives, and seeing our customer base expand far quicker than we ever anticipated,” said Mr. Steve Wourms, SIMAF technical director.

From the managerial perspective, SIMAF provides a consistent service to its customers, allowing for projects to be delivered within budgets, earlier than expected — and providing environments and products that exceed customers expectations.

## Recognition

Within the past year, SIMAF received a great deal of exposure from Air Force, DOD, and industrial and academic organizations.

The Defense Modeling and Simulation Office and Joint Expeditionary Forces Experiment (JEFX) 99 recently recognized SIMAF for excellence in virtual simulation, primarily in support of the Joint Strike Fighter program. The commander of the Air Force

Operational Test and Evaluation Center, Kirtland Air Force Base, N.M., recently recognized SIMAF for its significant impact on the JSF operational requirements document.

## Increasing usage

As the simulation facility acquires repeat customers and watches its customer funding increase dramatically, the facility still faces unique program challenges.

According to Mr. Wourms, the cost of virtual simulation is not trivial. “We’re on a fast track to bring down both our operations and maintenance cost, and our direct project costs,” he said.

While SIMAF’s customer base continues to expand, security continues to be one of the organization’s top priorities.

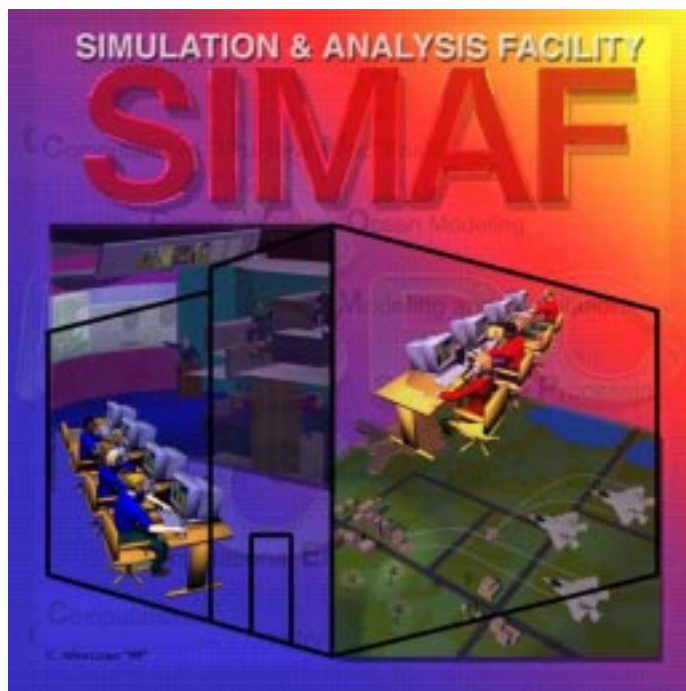
“The data is not ours, it belongs to our customers, and they have very demanding protection requirements,” said Mr. Wourms.

## Future

The organization has a number of future projects such as continued work with JSF’s aircrew systems advisory panel and Virtual Strike Warfare Environment programs. SIMAF people will also be involved in discussions concerning information surveillance reconnaissance simulation. “SIMAF people

expect to remain busy well into the next decade,” Mr. Wourms said.

— 2nd LT Kendall E. Brown, ASC Public Affairs



***SIMAF provides a flexible, secure simulation environment, enabling Wright-Patterson Air Force Base, Ohio, to promote simulation based acquisition by technologist, developers, acquirers, testers, sustainers, trainers and the operators.***

## Mission

SIMAF provides an integrated (virtual, distributed, and constructive) warfighter’s modeling, simulation and analysis capability suitable for design and operational evaluations during any phase of a weapon system’s life cycle. The facility also offers the ideal environment for assessing emerging or modified systems and their impact on the warfighter’s mission effectiveness.

## Capabilities

SIMAF’s experts can assist in the entire weapon systems development process, including up front, simulation planning; facility configuration; development of modeling software; execution of simulations; and performance of post-simulation analysis. Its connectivity promotes a collaborative environment in which potential, new designs can be accurately tested and evaluated in a system-of-systems, mission-level, real-time theater of operations. Capable of running multiple programs simultaneously at various security levels, SIMAF offers warfighters total immersion in synthetic, air-to-air and air-to-ground battle-space environments. With state-of-the-art visual displays and up-to-the-minute data interpretation, SIMAF will offer high-level decision-makers indisputable proof that their future weapon systems choices are the best, based on highest performance and lowest cost.

# AEDC takes modeling and simulation

**C**omputational modeling and flight simulation, combined with skilled personnel and other aeroprediction methodologies, are taking Arnold Engineering Development Center, Tenn., into the next millennium of testing.

Mr. Marc Skelley, aerodynamics project manager, describes integration testing as a knowledge-based approach to development, test and evaluation that reduces cost by increasing computer modeling and wind tunnel simulation accuracy and fidelity. It also reduces the number and duration of individual flight tests required and flight test costs.

The Air Force is using the data to construct an aerodynamic database as a tool to further research missile maneuverability, hit-to-kill accuracy and multi-role concepts for advanced missiles.

## Store separation

At transonic speeds, and at certain altitudes or maneuver conditions, an aircraft's stores, bombs, missiles or drop tanks carried externally, may veer upward when released and collide with the aircraft.

The problem of clean store separations, investigations of aerodynamic forces that can alter the planned trajectory of air-launched bombs or missiles, is explored in the 16T, 16S and 4T wind tunnels. To perform such an investigation, the aircraft model is mounted upside down in the tunnel on a special support system attached to the floor of the test section.

The store model is mounted on another sting attached to the top of the test section, and the two models are mated as they would be in flight. When the desired simulated flight conditions are established in the tunnel, the store model is "launched" from the parent aircraft model by activating a computer that controls movement of the sting-supported store as it traces the trajectory.

Wind tunnel tests conducted on the Air Force's F-22 Raptor aircraft satisfied requirements for flight testing scheduled in 2003. These requirements included the successful separation of the AIM-9X missile and the 600-gallon fuel tank plus pylon.

According to Mr. Doyle Veazey, test project engineer, testers used models of the F-22 aircraft, the 600-gallon tank plus pylon and the AIM-9X to evaluate data from Mach 0.4 to 1.95 at various flight conditions in the center's 4T tunnel.

This test completed a series of eight F-22 Program Office-sponsored store separation wind tunnel tests planned within the engineering manufacturing development stage—a phase conducted to ensure Air Force requirements are met or exceeded by the aircraft.

## A new direction

Ground testing and evaluation tools are not limited to the center's wind tunnels. AEDC uses computational capabilities, including Computational Fluid Dynamics (CFD) and pressure sensitive paint (PSP) techniques.

Used to supplement wind tunnel testing, Computational Fluid Dynamics is a method that involves using computational mechanics (simulating of the behavior and motion of fluids and solids) to assess aerospace

systems.

Through an alliance with NASA's Glenn Research Center and the Boeing Company, as well as with the University of Tennessee Space Institute, the center is contributing to the continuing evolution of computational fluid dynamics technology in aerodynamic testing.

In 1992, Arnold, UTSI and Motlow State Community College entered into an alliance that focused on resource sharing. The institutions resolved "to promote better communications and to explore ways to eliminate barriers to an alliance of mutual benefit."

The resolution included promoting mutually beneficial education and training with collaboration of science- and technology-related programs in the community and to develop courses in engineering, mathematics, management and history of technology.

"We're prepared to invest a lot to make sure Arnold is the place to be for computational test work," said Dr. Dwayne McCay, University of Tennessee Space Institute vice president for research and information technology. "We want to bring in the best in the world in computational mechanics — professors and students. We want to share capabilities and people with Arnold to make this team the best in the world in developing computational methodologies to support aerospace systems."

"Now, we primarily use computers to validate wind tunnel testing. Soon we'll primarily use wind tunnels to validate computer testing. Wind tunnels will still be needed, but computers will be where most of the testing takes place. That's why I think the push for the Arnold community to be the world's best in computational fluid dynamics should be even more fervent...I believe our professorship can be a big part of that."

The ground flight simulation testing provided by Arnold before flight reduces risks, and saves lives, equipment and money in operational testing. For instance, in past years, bombs were carried and dropped out of bomb bays. But as high-thrust engines became available, the weapons could be shifted outside and carried in considerable numbers on pylons attached to the lower surface of the wings.

"Problems became evident when aircraft speed became progressively faster," Mr. Skelley said. "Large, unexpected aerodynamic forces were sometimes generated, resulting in vibrations violent enough to render the aircraft uncontrollable by the pilot."

This aerodynamic condition, known as "flutter," can lead to breakup of the craft and has been extensively investigated in PWT's 16T and 16S tunnels. Within the last year, Arnold has integrated an improvement on the technique of pressure sensitive paint to assist in the aerodynamic investigations.

## Pressure sensitive paint

A Multi-View Pressure Sensitive Paint Data Acquisition System was installed and tested in Arnold's 16-foot transonic tunnel last year.

"Pressure sensitive paint presents Arnold customers with the opportunity to obtain critical wind tunnel data earlier in the design cycle—reducing the risk to the program," said Mr. Marvin Sellers, the pressure sensitive paint technical

# on into the new millenium

lead. "Also, as aircraft configurations can change during the test and evaluation phase, pressure sensitive paint can provide pressure data on the latest configuration, without the expensive and time-consuming process of constructing a new pressure loads model."

Arnold first became involved with the ever-evolving technology of pressure sensitive paint in 1993. The technique uses a special paint and illumination source combined with an extremely sensitive camera to obtain surface pressure data. The paint is applied to the model in two layers — a white undercoat and the pressure sensitive paint layer. The white undercoat provides a uniform reflective surface for the pressure sensitive paint layer.

The Lockheed-Martin Astronautics' Evolved Expendable Launch Vehicles program was the first test to use the Multi-View Pressure Sensitive Paint Data Acquisition System at Arnold. Testers used the system to acquire surface pressure data for the EELV by examining it at various angles of attack and speed at simulated flight conditions.

A pressure-sensitive paint demonstration test conducted in Arnold's 16T tunnel produced results which illustrated pressure sensitive paint capability for determining aerodynamic loads in wind tunnel tests as well.

"Aerodynamic loads on surfaces such as leading and trailing edge flaps, horizontal tails and the rudder are essential to aircraft manufacturers in actuator and internal structures design," said Mr. Sellers.

"The accepted method for acquiring this data has been through a specially designed wind tunnel model instrumented with hundreds of pressure taps distributed on the surface of the model. The pressure data are integrated over areas of the surface to determine the panel loads and load distribution. The models are costly and require several months of fabrication."

The test crew applied pressure sensitive paint to a 1/9-scale F-16 aircraft model with 600 pressure taps. During the test only 400 of the taps were connected to conventional pressure measuring instrumentation. Both the pressure sensitive paint and conventional pressure data were acquired simultaneously at angles of attack from zero to 26 degrees at speeds varying from Mach 0.6 to 1.2. The aerodynamic loads from the pressure sensitive paint data were compared to loads calculated from conventional pressure data.

"The test was very successful," he said. "The system performed as expected and proved itself very capable."

Comparisons of the conventional and pressure sensitive paint and the integrated loads from the conventional and pressure sensitive paint methods showed excellent agreement at high transonic and supersonic conditions.

According to Mr. Sellers, the F-16 pressure sensitive paint test presented a few issues to address before the system will be qualified to eliminate the pressure models. "We've been working with the pressure sensitive paint technique for quite a few years, but in limited fashions that haven't brought up some of the challenges we encountered with the F-16 test, and so we have an opportunity to improve the technique," Mr. Sellers said.

— Ms. Danette Duncan and Ms. Dana Davis, AEDC Public Affairs

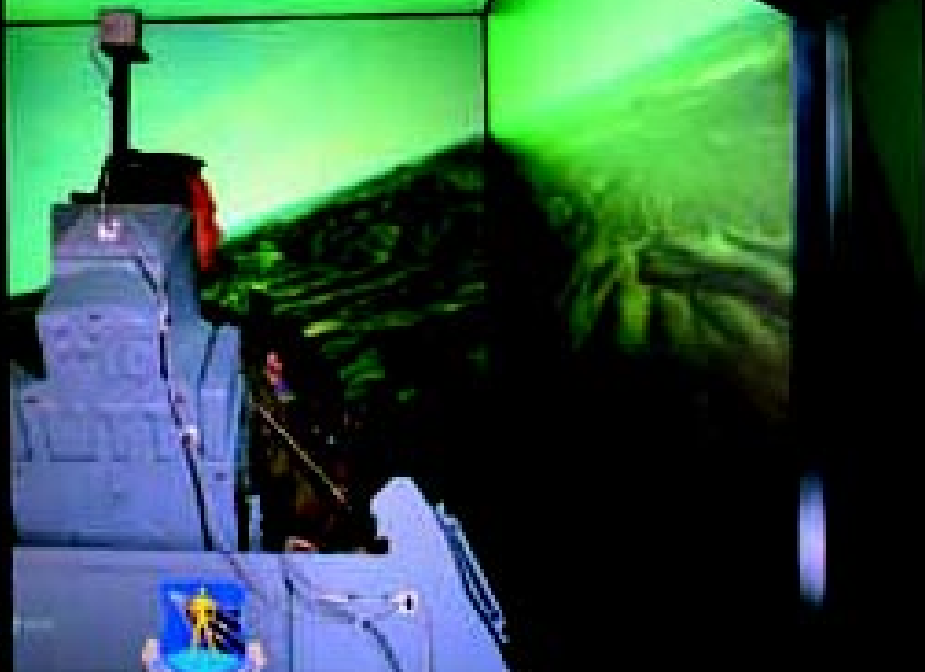


*The two graphics are of (left) the Global Hawk and (above) the Evolved Expendable Launch Vehicle (EELV) using pressure sensitive paint.*

# Power by the hour

May Gary Schmitt from the Air Force Research Laboratory in Texas, Dallas, Texas, and F-16 simulator over Nellis Air Force Base, Nev. The real-time simulation imagery is generated in real time by a custom graphics rendering computer.

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Offering a better way for aircrews to practice real-world missions, Distributed Mission Training (DMT) is changing how the Air Force prepares for war.

"Air crews today have limited capability to train the way they will fight tomorrow," said Col. Michael Chapin, chief, Revolutionizing Training Division, Training Systems Product Group, Aeronautical Systems Center, Wright-Patterson Air Force Base, Ohio. "There's only one exercise a year — Red Flag at Nellis Air Force Base, Nev. — where they all get together to train for war with platforms other than their own. We want to give aircrews team training to compensate for real-world limitations, distributed mission training will soon give them that chance every day."

With roots in a 1997 decision by Gen. Richard Hawley, former Air Combat Command commander, to increase simulator-based training for warfighters to 15 hours per month, DMT focuses on creating simulations so real that they produce "sweating, smiling" pilots, who believe they've flown real missions.

"These guys love DMT, because it is the best simulator capability they've seen," said Col. Chapin. "Although we know that simulator training will never totally replace the experience of real flight, the fidelity of the DMT cockpits is 100 percent. The visuals are so true that what you 'see' from inside the simulator cockpit is what you would see during an operational mission."

## Beginnings

Distributed mission training began in November 1997, with award of a \$574 million, 15-year contract to Boeing Corp., St. Louis, Mo., for F-15C Commercial Training Simulation Services, said Col. Chapin. The objective is for wraparound (360 degrees)

visual systems to perform real-world combat maneuvers.

"The F-15 MTC [Mission Training Center] will provide a complete training environment, including threat and instructor and operator stations, plus brief and debrief capabilities so pilots can review what they've learned during simulated missions," Col. Chapin said. "The F-15C MTC began operation in 1999, first at Eglin Air Force Base, Fla., in May, then in June at Langley Air Force Base, Va. In time, we plan to deploy DMT capabilities to all F-15 units in the United States and overseas."

In July 1999, a similar \$249 million, 15-year contract was awarded to Lockheed Martin Integrated Systems, Akron, Ohio, for an mission training center capability for F-16 Block 40/50 mission training needs. "The initial F-16 DMT services will start at Shaw Air Force Base, S.C., in April 2002," Col. Chapin said. "By 2003, we plan to extend these services to Mountain Home Air Force Base, Idaho. In time, DMT will be offered to all F-16 units worldwide."

## DMT support to AEF

By November this year, Airborne Warning and Command System (AWACS) aircrews based at Tinker Air Force Base, Okla., will use DMT capabilities for full-mission training. "Under a \$75 million, 15-year contract awarded in February 1999, Plexsys Interface Products, Inc., Portland, Ore., will provide simultaneous training for all positions of an integrated AWACS team — 14 mission crew operators and six instructors," Col. Chapin said.

"By linking AWACS crew training to live pilots at geographically-separated locations, DMT is serving as an enabler for the Aerospace Expeditionary Force (AEF) concept," Col. Chapin said. "It reduces temporary duty travel, by allowing — continued on page 16

# OPNET – identifying shortfalls in critical war reserve materials

Researchers at the Air Force Research Laboratory's materials and Manufacturing Directorate, Wright-Patterson Air Force Base, Ohio, and Decision Sciences, Inc., have developed an advanced computer simulation and modeling program that analyzes the readiness levels and capabilities of the nation's war reserve material.

Their operations network (OPNET) industrial base simulation program provides the ability to identify current or future shortfalls in critical reserves, such as munitions, and estimates the re-supply times.

This program was initiated to more accurately assess U.S. combat readiness and the condition of the nation's munitions industrial base. Air Force Materiel Command leaders needed to determine the feasibility of computer modeling the munitions industrial base and simulating replenishment times.

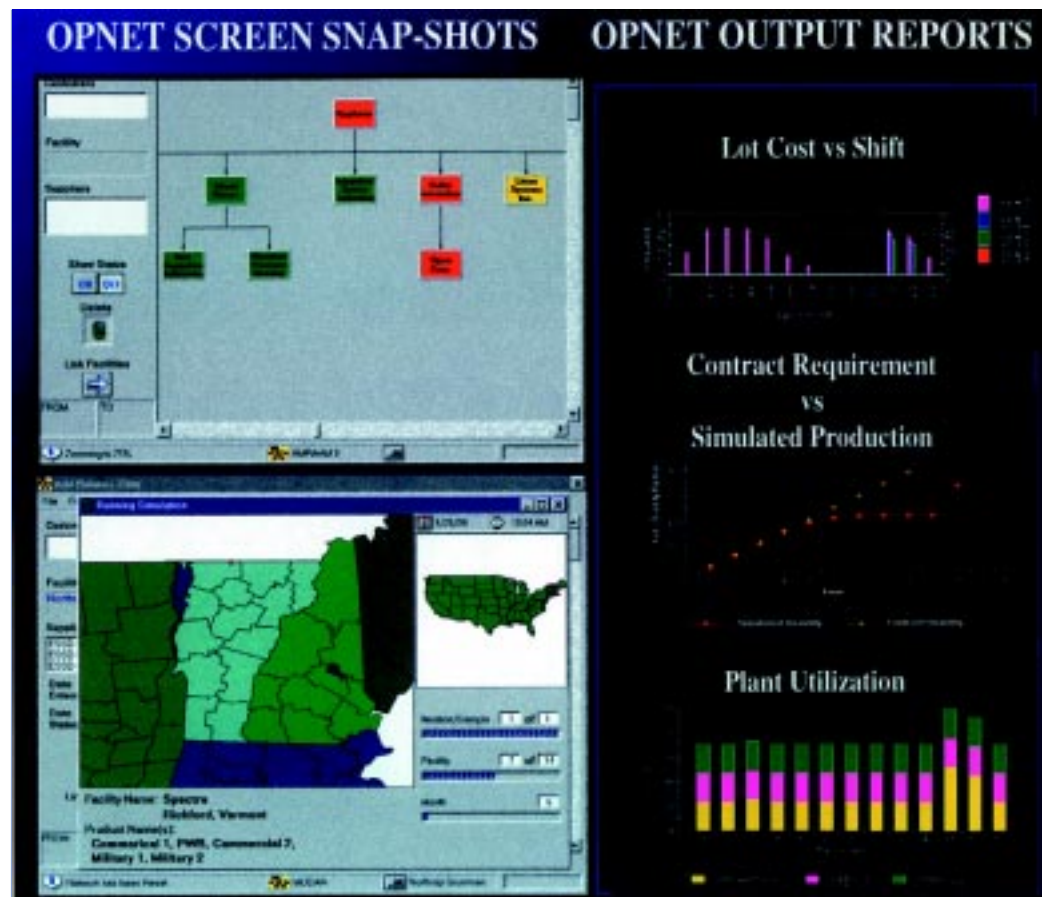
At the same time, they wanted to reveal problems and investment opportunities. Under a contract with the laboratory, engineers and scientists at Decision Sciences Inc., developed the OPNET Industrial base simulation program to provide advanced tool and spin-off methodologies for assessing and analyzing readiness levels and capabilities.

The OPNET program is user-friendly software that allows the operator to construct a hierarchical representation of the nation's industrial base and graphically link war fighters' requirements with supply and replenishment capability. It allows users to analyze current problems and look into potential future needs and limitations of the nation's weapons industrial base.

OPNET has been used to assess the early program capabilities of BSU-93 air inflatable retarder for the M-117 demolition bomb, and more recently, the manufacturing and supply industrial base for the advanced medium range air-to-air missile (AMRAAM).

OPNET will improve the nation's warfighting capability by showing the needs and limitations and allowing operators to more accurately measure the impact of cost, schedule and program changes that affect the outcomes of major regional conflicts.

As OPNET evolves, it continues to generate considerable interest from industry, the nation's military forces and government agencies. The OPNET program was presented at the Naval logistics war games and was exhibited at three consecutive defense manufacturing conferences. OPNET was a topic



of discussion at the advanced industrial practices and tools mini-symposium. It was exhibited again at the Air Force Institute of Technology "Focus on Information Technology Show" and at two defense capabilities workshops.

OPNET has also been presented to the Industrial College of the Armed Forces where it is being considered for application as an instructional tool for training and educating future Air Force leaders. Instructors at the Air Force, Army and Naval war colleges have also expressed an interest in using it for educational needs.

A successful demonstration of the OPNET computer simulation and modeling program was performed to evaluate the capability of an Army ammunition plant to provide needed weapons during a hypothetical conflict and to assess the potential impact on war-waging capability should the facility be closed.

The OPNET computer simulation and modeling program provides an effective means for assessing and analyzing the readiness levels and capabilities of critical sectors of the U.S. war reserve material replenishment structure. It has the potential to significantly improve fighting capability by allowing the operator to quickly and easily measure cost, schedule and program changes that can affect the outcomes of major regional conflicts.

— Mr. Fred Coleman, AFRL Public Affairs

# SMC's Developmental Planning Directorate

## *Planning the future of space for more than 30 years*

How do you go about designing satellites and space architectures for 2025 and beyond — and perform tradeoff studies that incorporate technologies that don't exist today? After a design is pinned down, how do you demonstrate its military use — given that the environment it must operate in doesn't exist and won't exist for 25 years? What is the cost associated with procuring, operating and sustaining such systems? How do you advocate an investment strategy so all the pieces are in place when the time comes to field these future systems?

Answering these challenging questions is the mission of the Space and Missile Systems Center, Los Angeles Air Force Base, Calif., Developmental Planning directorate. Located a few miles south of Los Angeles International Airport, this has been the future of space for more than 30 years. Concepts have evolved into project offices, program offices and fielded systems that warfighters depend on.

To the trained engineer, the above questions represent a classic case of too few equations and many unknowns — the realm of design. That's where the Aerospace Corporation's concept design center (CDC) comes into play. At the center, satellite subsystem teams interact in a collaborative fashion, performing "what-if" exploration of design space until a solid configuration and architecture meet the needs of warfighters. As one might expect, M&S plays a key role in representing technologies in the design space of the future.

M&S is the lifeblood of another directorate facility — the Decision Support Laboratory where designs and architectures developed in CDC are explored to optimize and determine their military use. The DSL uses the THUNDER campaign model, the Air Force-developed System Effectiveness Analysis Simulation (SEAS) multi-

mission model, and other models to determine a future concept's "value added" to the fight.

While THUNDER is a well-recognized model in the joint air community, the directorate has tried to augment it with valid space representation. The most recent THUNDER release includes space-based radar, global positioning system, these space-based infrared

January 2001.

Through more comprehensive space representation in wargames and exercises, warfighters study how to apply capabilities of future systems so the Air Force is ready to put space capabilities to use as soon as they're operational.

Connectivity is a big initiative in the M&S community. SMC's DSL is directly linked to Aeronautical System Center

(ASC), Wright-Patterson Air Force Base, Ohio, and Electronic Systems Center (ESC), Hanscom Air Force Base, Mass., and the theater air command and control simulation facility at Kirtland Air Force Base, N.M. This provides connectivity to many additional DOD facilities. SMC, Air Force Space Command (AFSPC), and the Aerospace Corporation are contributing to an M&S hub in Colorado Springs at the corporation's Atrium II facility. This facility will enable more collaborative M&S in the future, similar to a current "Pathfinder" space-based radar study being

conducted jointly by SMC, ASC, ESC, and AFSPC's space mission integration office. The advent of simulation based acquisition introduces an era where such collaborative efforts will become commonplace to leverage the collective modeling and simulation capabilities of geographically separated facilities without having to duplicate those capabilities.

Advances in computing technology, materials and processes make this an exciting time to shape the future of space. The sky's no longer the limit, it's only the beginning!

— Maj. Jeff Irwin, chief, SMC modeling, simulation & analysis



system, the enhanced theater ballistic missile and high-energy laser representation. This model, providing quick reaction analysis capabilities, was accepted in the Air Force Suite of Models in September 1999.

System effectiveness analysis simulation is an agent-based model, allowing units as low as flight level to respond to events logically, as opposed to relatively coarse probabilistic methods of THUNDER (with minimum resolution being an entire wing). The use of SEAS was demonstrated in the Army after Next Space Game 1999. It will be demonstrated again at Global Engagement V Wargame, and will be a key quick reaction analysis tool used in the first Air Force Space Game slated for

# Weather squadron predicts more than just weather

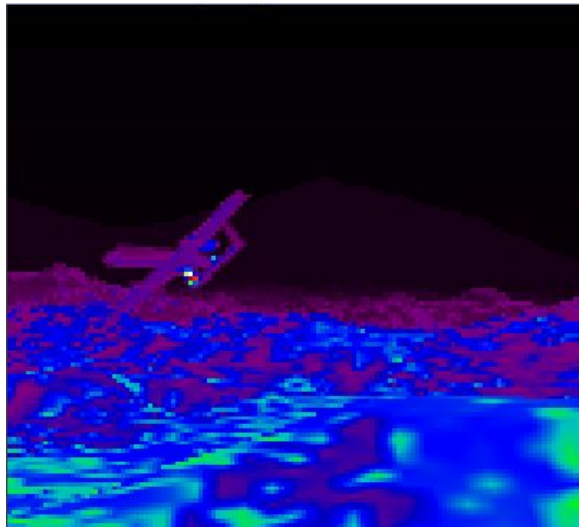
If you think your friendly weatherman only forecasts the next local thunderstorm — think again.

At Aeronautical Systems Center (ASC), Wright-Patterson Air Force Base, Ohio, the 88th Weather Squadron is helping Air Force warfighters train the same way they will fight future wars, and defense acquisition planners produce the best, most cost-effective, new weapon systems, by creating true-to-life, simulated weather and threat conditions in a virtual battlespace.

According to Lt. Col. John Lanicci, 88th WS commander, his squadron has been involved in several efforts to integrate weather and weather-effects into modeling and simulation.

“Our goal is to create a more realistic, effective simulation environment for DOD training, acquisition and analysis communities,” said Col. Lanicci.

Several ASC defense acquisition efforts are using his squadron’s talents, among them the Joint Modeling and Simulation System (JMASS) and the Distributed Mission Training (DMT) programs.



*Two false-color images of an A-10 flying over terrain: the first image is under clear, no-cloud weather conditions, and the second is in heavy rain. The image is as a three-five micron wavelength sensor would see the scene.*

## Put to use

“JMASS is a joint-service program focused on saving weapons systems lifecycle costs by producing engineering and engagement-level [simulation] models of blue [friendly] and red [enemy] systems, to help aerospace designers and warfighters assess their effectiveness in a threat environment,” said Mr. Kirk Lehneis, squadron research meteorologist. “We’re helping JMASS create a simulation capability for test and evaluation of new electro-optical and infrared weapons systems, saving taxpayer dollars by ‘testing’ prototype systems in cyberspace, before operational systems are built.”

“The JMASS electro-optical and infrared player allows the end-user to now build simulations that account for weather phenomena related to electro-optical and infrared sensor and/or seeker performance and aircraft detection,” said Mr. Lehneis. “Future enhancements will include the capability to ingest and use Rawinsonde [weather balloon] data, and the laboratory’s Cloud Scene Simulation Model for visualization.”

The squadron also has supported the DMT program, aimed at saving operational training costs and taxpayer dollars by developing and producing “virtual reality” cockpits to train geographically-separated pilots in various fighter, bomber, and command-and-control aircraft, simultaneously networked in multi-ship formations across the country and at several

overseas locations.

“We provided comprehensive review of the draft Operational Requirements Document and Task Training List for the F-16 Block 30 Distributed Mission Trainer, to ensure consideration of weather and weather-effects, to produce more realistic, effective DMT training,” said Capt. Glenn Kerr, squadron aeronautical meteorologist.

## Advantages

Serving as the Air Force lead on the Joint Service Integrated Weather Effects Decision Aid program, the 88th Weather Squadron combines weapon systems weather sensitivities with

computer-generated forecast weather parameters, according to Capt. Kerr and Capt. Nathan Drummond, aeronautical systems meteorologist.

“Our squadron is collecting weather sensitivities for all Air Force aircraft and subsystems,” Capt. Drummond said. “We’re working with Air Staff and other agencies to validate the collected data, so this process is applied with full confidence to many different operational uses.”

“In time, these sensitivities will form a data set for inclusion in Air Force, Army and Navy command-and-control decision-making systems,” Capt. Kerr said. “Eventually, DOD should be able to use these weather data sets to tactically and strategically exploit advantages over enemy forces, particularly during adverse weather conditions during short-term contingencies or protracted war.”

Working closely with DOD Air and Space Natural Environment M&S Executive Agent, the squadron is working several other projects to supply realistic, consistent, natural environment at the right spatial and temporal resolution for simulation applications, Mr. Lehneis said.

“The user will be able to find a weather data set that already exists — or if not, within 96 hours obtain one that is realistic and consistent for the location, time of year and day, based on past weather conditions.”

— Ms. Sue Baker, ASC Public Affairs



# Eglin supplies virtual weapon

Scientists and engineers from the Air Armament Center (AAC) and Air Force Research Laboratory Munitions Directorate, both located at Eglin Air Force Base, Fla., recently took a step toward fulfilling a vision of providing virtual weapons for warfighting exercises.

Virtual prototype missiles called Low-Cost Autonomous Attack System (LOCAAS) from Eglin were loaded on four Joint Strike Fighter simulators at Wright-Patterson AFB, Ohio, and Naval Air Station Patuxent River, Maryland.

Joint Strike Fighter pilots dropped dozens of these low-cost autonomous attack system weapons as they participated in the Joint Expeditionary Forces Experiment (JEFX-99) in the summer of 1999.

Eglin computers simulated, multiple weapon flight paths, search patterns, target recognition algorithms and warhead effectiveness for the 100 pound missiles.

"This project has proven our ability to dynamically represent air armament in the emerging virtual or synthetic battlefield environment," said Mr. Rich Woodard, Eglin Modeling and Simulation Integration branch.

Through a series of complicated communications links and computer

networks, munitions directorate engineers were able to watch and participate as the simulated war game unfolded. "It was the perfect venue to introduce low-cost autonomous attack system weapons," said 2nd Lt. Terry Brouska, munitions directorate program manager for the integration of LOCAAS into JEFX-99.

"This is the first time an advanced, conceptual weapon has been integrated with a conceptual aircraft to participate in a joint war-gaming exercise."

The six month, quick reaction project was funded in part by the East Coast Communication Network project, which sponsors projects that network a variety of test ranges and development facilities.

War-gaming exercises such as JEFX-99 give Eglin engineers the opportunity to insert emerging weapon technologies into the synthetic battlespace, allowing warfighters to explore performance and concepts of operation for a weapon system before issuing formal requirement documents.

Smart weapons require pilots to plan both aircraft and weapon missions. Weapons like LOCAAS that can be reprogrammed by the pilot in-flight, potentially add workload to the already

complex tasks of flying the aircraft, avoiding enemy defenses and searching for targets.

Pilot workloads are evaluated during these virtual battles. If a target attack is unsuccessful, engineers can replay the mission and determine why the target was not destroyed.

Results from JEFX-99 indicate LOCAAS is the weapon of choice by joint strike fighter pilots when an autonomous, search and kill weapon is needed to attack lightly and heavily armored ground targets.

"The Air Force Research Laboratory's Munitions Directorate has led the way by developing the LOCAAS engagement analysis capability," said Mr. Woodard.

"We must now further develop this capability to include other developmental and inventory weapons so that virtual battlespace participants can access multiple validated and accredited weapon simulations in real time."

Thanks to these synthetic battlefield exercises, Eglin can facilitate early warfighter participation in weapons development and gain valuable insight into how these weapons will be used in a real conflict.

— Mr. Allen Baker, AAC Engineering

## Command and control warfighter exercise successful at Hanscom

The Command and Control Warfighter Demonstration, held at Hanscom Air Force Base, Ma., February 23-29, showcased what the Electronic Systems Center (ESC) is all about. The demonstration, featuring a fictional wartime scenario, also showed how the various technologies developed and acquired by ESC work together to support combat operations. "This was an opportunity to showcase our technologies while demonstrating the importance of command and control," said commander Lt. Gen. Leslie F. Kenne. "C2 plays a significant role in each step of wartime operation, from planning through execution. I think it's important to highlight the resultant need for interoperability among these systems."

The demonstration began with an intelligence briefing,

followed by a deployment planning session that featured a mock deployment line. Attendees then proceeded through a series of cells further illustrating ESC's contributions to a combat mission. The formal part of the demonstration concluded with an outbrief recapping of the day's activities.

Following the outbrief, visitors toured shelters containing technologies being developed for future use, which are anticipated to enhance the impressive array of capabilities exhibited in the demonstration. U.S. Air Force Assistant Vice Chief of Staff Lt. Gen. William Begert, who toured the demonstration on February 29, noted the professionalism of the briefers. "I was very impressed with the young people who gave the briefings," Gen. Begert said. "They were very articulate in giving their piece of the scenario."

Imagine a plane that never burns a drop of fuel, never calls for extended maintenance downtime and never needs clear blue skies to fly anytime, anywhere. Undoubtedly, it would be perfect for the Air Force testing community.

Imagine no more. Such a plane exists now in the form of an F-22 Raptor that soars on computers as part of a modeling and simulation program.

A recent addition to the Raptor modeling and simulation program, known as the Advanced Flight Propulsion Data Validation and Analysis System is being used at Edwards Air Force Base, Calif., and Arnold Air Force

Edwards and the other covers ground testing at Arnold.

Edwards performs in-flight developmental testing of installed propulsion systems while Arnold conducts ground-based altitude developmental testing of current and future propulsion systems. Though both units have their own particular requirements, they achieve it in similar fashion: validating parameters, which can run from a couple of hundred to several thousand for each test.

Currently, propulsion testing for the F-22 involves about 1,200 instrumentation measurements. The flight-test data portion of that is validated solely by reviewing in real-time a subset of

the current data acquisition process," said Mr. David Kidman, lead propulsion engineer for the F-22 Combined Test Force at Edwards.

How? By reducing re-fly requirements due to faulty instrumentation. "This software allows a basic scan of all raw data, during modeling and simulation tests, to ensure quality prior to release for further analysis," Mr. Kidman explained.

Just like Edwards, Arnold is hoping the system proves successful in reducing testing elements such as cycle time.

Just ten years ago, it sometimes took a month to process and validate all propulsion data after collection. Since that time, it's been reduced down to anywhere from one to six hours. But with this new system, "we will be able to

do it in real time," said Dr. Don Malloy, lead propulsion engineer for the data analysis team at Arnold. "Obviously, we are trying to catch anomalies as they occur."

Development of this new system has depended on Edwards and Arnold working together as an alliance. It has delivered "an example...in which all test centers must work together, applying coordinated test techniques and planning to give the F-22 program the most cost-effective and efficient support," said Col. Craig

Christen, Arnold director of operations.

As for the overall F-22 program, modeling and simulation has played a big part in steadily proving that the Raptor will, indeed, become our next-generation air-superiority fighter.

It's a continuous cycle where pilots go up knowing what to expect due to modeling and simulation predictions. Test data is then compared to the models, which are then tweaked to further mature the system.

— Mr. Ray Johnson, AFFTC Public Affairs

## The perfect aircraft

Base, Tenn., to reduce data turnaround time, lower cost and enhance data quality.

With the Air Force emphasizing streamlined aircraft acquisition, major test centers are evolving new paradigms for cost and knowledge sharing when developing aero-propulsion systems. One such area: designing modeling and simulation tools to support ground- and flight-test propulsion operations.

By using modeling and simulation tools, Edwards' Air Force Flight Test Center and Arnold Engineering Development Center will soon be able to make quick, accurate predictions of in-flight propulsion system characteristics.

Such capabilities would lend to significant reductions in propulsion test matrices, thus shortening overall test time and enhancing safety.

"We believe modeling and simulation can achieve these goals, which would improve quality all the way around," said Mr. Allan Webb, chief of Edwards' Propulsion Integration Branch.

This validation and analysis system, which is about halfway through a three-year development phase, is actually two programs. One involves flight testing at

parameters during a test mission. However, an engineer with current control room automation tools can only observe about 300 of 500 parameters gathered by telemetry.

Plus, when instrumentation is found to be non-operational during a more detailed post-test analysis, it's often too late to regain the information needed, which means re-flying the mission, which costs money.

The new data validation system, when fully developed, "will fill a void in



# ESC technologies...better, faster, cheaper

A Hanscom Air Force Base, Mass., program office is proving daily that command and control acquisition can be faster, better and cheaper by using modeling and simulation.

Appropriately called the Modeling, Analysis and Simulation Center, led by Lt. Col. Scott Ley and his operations officer Maj. Ron Martin, the office is part of the Integrated Command and Control System program office, directed by Col. Edward Mahan.

"Essentially, using modeling and simulation allows the Electronic Systems Center acquisition process to deliver a more operationally effective integrated command and control system to the warfighter," Maj. Martin said. With modeling and simulation (M&S), program managers are able to make better tradeoff decisions before actually "bending metal" on a project.

"Our modeling and simulation folks support four key areas: command and control training, analysis, testing and simulation-based acquisition," Maj. Martin said. "For instance, our national air and space model program office is developing a next-generation model to train operators at the air and operations centers and wing operations centers in exercises and experiments such as Blue Flag, Ulchi Focus Lens, and Joint Expeditionary Force Experiment."

The national air and space warfare model will replace the current training model called air warfare simulation being used to support these events.

With modeling and simulation, commanders can simultaneously work with fielded systems, such as AWACS, and with yet-to-be-built aircraft such as the Joint Strike Fighter.

The greatest benefits of M&S are the manpower and dollar savings. For example, the staff at an AOC can train to generate 1,000-plus sorties at a small fraction of the cost of using actual planes. Modeling and simulation can be used to support analysis in a broad sense, such as the value of an entire Joint Surveillance Target Attack Radar System, or focused on just the radar portion of that system.

Analysis can also be used to show the military utility of a command and control system in an air campaign or a specific mission such as time-critical targeting. The Modeling, Analysis and Simulation Center used M&S to create a synthetic environment that successfully linked virtual fighters such as the F-16 at the Aeronautical Systems Center, Wright-Patterson Air Force Base, Ohio, and a space-based radar model at the Space and Missile Center, Los Angeles Air Force Base, Calif., to conduct a

proof-of-concept demonstration. As a follow-on, the center is supporting a pathfinder effort which will support an Air Force Space Command analysis of alternatives to space-based radar.

Linking M&S models with Joint Strike Fighter models helps that program office decide what systems need to be carried on the fighter as well as what remote systems can feed into it.

"We work with a number of organizations to support testing, exercises, demonstrations and experimentation," Maj. Martin said. "The office is supporting a United States Joint Forces Command study effort called 'Pegasus' where we will tie together five or six different simulations from the Air Force, Army and Navy to examine the best way to conduct attack operations in the future."

Command and control simulation-based acquisition uses simulation technology that is integrated across all acquisition phases and programs.

The intent is to reduce time, resources and risks associated with the command and control system acquisition process, while increasing quality, military utility and supportability.

"In the past we built a prototype of a new system that would be sent to the field and, while it often functioned as it was supposed to, it was frequently 'stove-piped' work with

any other system," Maj. Martin said. "Now we build a prototype and use modeling and simulation to do integration and interoperability testing, making sure it can talk to other systems there. Then we give operators a chance to work with it before we field it. They may request some changes or enhancements to the system."

This "spiral development" process is repeated until the system is ready to field.

"With simulation based acquisition, we would not necessarily build the prototype first. Instead we would model it, show how it interfaces with other systems and use a variety of tools to determine its military worth before we build it," Maj. Martin said.

"We have the technology now as a modeling and simulation service provider to the system program offices and war fighters to support the delivery of better command systems, quicker and at significant cost savings," he said.

— Mr. Roy Heitman, ESC Public Affairs



**Sean Greenwood (foreground) and 1st Lt. Mark Nolley of ESC's Modeling and Simulation Center, work on an Extended Air Defense Simulation. The scenario on the screen is called Pacifica from the Joint Expeditionary Force Experiment 99.**

# A quantum leap

## High-performance computer improves modeling, simulation

**T**he 21st century is still officially a year away, but with the awarding of a souped-up computer system, the Air Force Flight Test Center, Edwards Air Force Base, Calif., is drawing ever closer to it — technology-wise that is.

That advancement comes as the Department of Defense high performance computing modernization program bestows the center \$3.6 million to acquire high-performance computing capability.

### High performance community

With it, Edwards will become a high performance computing distributed center and one of 17 sites linked to the defense research engineering network, an association of DOD's high-performance community.

Mr. Peter von Klargaard, chief of the High Performance Computing Office at Edwards, labeled the quantum technological leap as "a milestone for us." "During the next year we will build a world-class computational facility that will improve our testing capacity," he said.

Advancing the center's flight testing and evaluation role is why Edwards asked for high-performance computing capability.

### Experimental programs

As the lead Air Force center for flight testing since the 1940s, Edwards' people conduct advanced developmental and experimental flight test programs.

But those early aircraft performance tests were geared as much around the human element as around aircraft mechanics.

Modern airborne weapon platforms, have become increasingly more complex and geared heavily toward the proficiency of on-board computers.

And as aircraft complexity rises, so does the cost and risk of testing. Furthermore, such complexities drive the need to build a more thorough testing battle space for each test objective, Mr.

having to do only flight testing."

### Reducing costs

The end result is cost reduction and increased efficiency. High-performance computing is actually two systems; one does complex computations for engineering analysis and the other provides visualization images.

Both will come in handy for the center's Electronic Warfare Directorate, which is primary a high-performance computer user.

The Electronic Warfare Directorate will use visualization technology to feed graphics into a 360-degree simulator dome that looks, sounds and feels like an actual cockpit. What they will have is an aircraft and its system that never leaves the ground, despite being flown for hours.

Already upgrading modeling and simulation capabilities, directorates welcomed the high-performance-computing

announcement.

"The high fidelity models that the directorate is developing require a very powerful computer system to create visuals our models require," said Mr. Guy Williams, program manager, electronic warfare M&S.

### Lessons learned

Besides using high-performance computing to develop models to simulate electronic warfare battlefields, Edwards people will also use it to feed flight test "lessons-learned" back into the modeling and simulation community to improve those models with live test results.

By using proven models to reduce risk and guess work in testing very complex weapon systems, high-performance computing will "provide for the delivery of a product of greater quality and predictability to the war fighter," Mr. von Klargaard said.

— Mr. Ray Johnson, AFFTC Public Affairs



Ms. Kristle Hogbin, AFFTC

**Mr. Steve Sawyer, from the Air Force Flight Test Center, Edwards Air Force Base, Calif., Electronic Warfare Directorate, connects cables on High Performance Computing computers the center recently received.**

von Klargaard said.

He added that a shift from testing the basic performance and flying qualities of an aircraft to the rigorous testing of integrated "system of systems" drives the need for more flexible and powerful high-performance test and support tools. With that change comes cost, which must be curbed because of ongoing budget constraints.

How? By changing the length and nature of test cycles, which includes the predictability and proficiency of each test to minimize re-test and surprises.

The answer is high-performance computing, especially when it comes to modeling and simulation programs.

"We are always going to do live flight testing — that's what we do best," said Mr. Richard Kosick, high performance computing technical lead.

"But we ultimately hope to optimize it with modeling and simulation. There are some tests, we believe, that we will be able to develop models for instead of

# Engineers model laser performance

**T**he Airborne Laser is a 747-400 aircraft armed with a chemical laser designed to destroy theatre ballistic missiles. Although the plane will not be operational for a few years, the laser itself is being tested, in part, through modeling and simulation techniques at Kirtland Air Force Base,



**Dr. Timothy Madden (right) explains to a colleague where the Chemical Oxygen-Iodine Laser is located on the Airborne Laser 747-400 aircraft.**

N.M., by the Air Force Research Laboratory's Directed Energy Directorate (AFRL).

The chemical laser computer simulation is being run in conjunction with actual laser tests being conducted by TRW Inc. in their southern California facilities. This cooperation will ensure the successful demonstration of the first flight laser module next year.

## Testing

Both methods of testing are essential. By using computer technologies first, the lab can create better testing procedures, and save testing time and hardware costs.

The chemical oxygen-iodine laser used for the Airborne Laser is being modeled by AFRL to predict the advanced performance concepts for potential use in the next generation Airborne Laser. These tests are being conducted by a team of Logicon, Inc., Scientific Research Associates, and the High-Power Gas and Chemical Laser Branch of the Directed Energy Directorate.

The tests will explain, with the use of mathematical equations, exactly what is happening within the laser.

"There are many things within the laser to consider," said Dr. Timothy Madden, a scientist in the laboratory's High Power Gas and Chemical Laser Branch.

## Computer Technology

"We are using computer technologies to describe what's happening within the laser such as chemistry, gases, and optical physics. Through modeling and

simulation, we will save the government from having to purchase extra hardware and from paying for extended testing time," he added.

The project, entitled 3-D Computational Fluid Dynamic Modeling of the Chemical Oxygen-Iodine Laser, has been ongoing since 1993. Logicon Inc. has been providing modeling development and support since the beginning. Their primary business is to provide scientific and engineering support.

RDA/Logicon Inc., in conjunction with Scientific Research Associates, has been developing a 3-D model for the laser under Air Force Research Laboratory funding. It is this model that is currently being used to simulate the laser used in the Airborne Laser.

Dr. Madden, of the Directed Energy Directorate Laser Branch, is the principal investigator with the project and performs 3-D simulations using another model, built upon a computer code developed by Aerosoft, Inc. of Blacksburg, Va.

## Other programs

The laboratory is also working in support of the Airborne Laser with the Department of Defense High Performance Computing Monitorization Program. This program is designed to provide the United States military with a technological advantage to support warfighting requirements. It also provides DOD with advanced hardware, computing tools and training to researchers using the latest technology to aid in their mission — the testing of the Chemical Oxygen-Iodine Laser.

— Ms. Barbara Baca, AFRL Public Affairs

## Continued from page 8

crews who are grouped together as an AEF to rehearse missions before deploying from their home bases.

"DMT will simulate the entire spectrum of battlespace activities, ranging from single-ship engagements to full, theater-wide, composite forces that interact with other battle management command-and-control elements, such as an Air Operation Center," Col. Chapin said.

In another application, Air Mobility Command also has begun exploring how DMT could be applied to its training activities, with evaluation early this year of C-5 to C-5 networking at Dover Air

Force Base, Del.

"This project has now been extended to demonstrate long-haul connectivity from Dover to Travis Air Force Base, Calif., where KC-10 boom operators will soon be involved," said Col. Chapin. "And AMC is anticipating other uses for DMT, already incorporating High-Level Architecture into its C-5, KC-10 and C-17 trainer systems."

Distributed Mission Training also is poised to enter the joint-service arena, according to Col. Chapin. "We are working with the Navy to open up their network architecture, in a project dubbed 'Tasmanian Devil,' that will

demonstrate a link between F-18 and F-16 training simulators, to give service-specific pilots even more experience in the joint battlespace."

"DMT is designed to enhance, not replace, today's flying training programs, to make mission training more affordable and realistic," Col. Chapin said. "By providing training through distributed local and long-haul simulations, DMT will give warfighters the complex skills they need to deploy, and win, in an AEF environment."

— Ms. Sue Baker, ASC Public Affairs

## AFMC brings new help center web site on-line

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Air Force Materiel Command expanded support to its customers recently with the Headquarters AFMC Customer Help Center at <http://www.afmc-help.wpafb.af.mil>.

Customer access to the Air Force's most complex and diverse organization is easier now with the launch of a prototype interactive Web site that can be reached from Department of Defense .mil and U.S. government .gov domains.

The site is a component of AFMC's customer support toolbox. Unlike traditional customer service operations — with rows of technicians constantly manning phones — AFMC's site provides a portal to AFMC Web sites and selected databases.

"The Web site operates continuously, requiring a small fraction of personnel to staff a traditional customer service office," said Mr. Michael Self, one of the help center's architects.

"Our ultimate goal," Mr. Self said, "is to provide an answer or an appropriate point of contact referral on the Help Center Web site to 90-plus percent of our customers' questions."

"For those who can't find the answers they seek, there's human help available via e-mail and phone."

"Since the Help Center and its web site are both new, we'll be working hard to expand and improve by gathering customer feedback," Mr. Self said.

The Help Center offers easy connection to several references and database tools, allowing customers to perform a keyword search through AFMC Web sites, selected databases and a Web-based discussion bulletin board. It has links to readiness support tools such as logistics tracker and stock control system web.

— AFMC News Service

## Time capsule preserves history and aspirations

WRIGHT-PATTERSON Air Force Base, Ohio — Maj. Gen. Richard Paul, former commander of the Air Force Research Laboratory, suspended time when he buried a time-capsule April 4. The capsule, which Gen. Paul said provides a glimpse into the past and anticipated future of the laboratory, will

be opened in 2025.

The burial spot is identified with an engraved marker with instructions to exhume in 2025.

"We out-and-out borrowed this idea from Aeronautical Systems Center, who recently buried their own time capsule," Gen. Paul said. "When I saw their time capsule initiative, I thought, 'What a great way to start the 2000's' — so we're going to do the same thing."

"Almost all of AFRL's current leadership has been here since its inception," said Gen. Paul. "The beginning of this endeavor [1997] is fresh in our memories. We'd like to preserve some of our accomplishments and questions to remind future leaders of the lab's history."

The capsule is a diverse collection of contents that includes items from an organizational chart to base newspapers. It also includes a list of predictions for 2025, made by the Command Section and Technical Directors and a list of questions lab people hope are answered by 2025.

"We have significant aspirations for the future; however, remembering and recognizing our past is important in achieving future goals," Gen. Paul said. "We hope that the contents of the time capsule will help future leaders to reflect on their last 25 years and to identify goals for the next 25 years."

— AFRL Public Affairs

## USAF Museum welcomes Spitfire

WRIGHT-PATTERSON Air Force Base, Ohio — The U.S. Air Force Museum here expanded its historic aircraft collection Mar. 22 when it welcomed a renowned World War II fighter aircraft and three British museum restoration representatives to the Museum's restoration hangar.

The museum received a Supermarine Spitfire Mark Five, C model (Mk. Vc) and greeted British restoration colleagues Mr. Andrew Robinson, Mr. Keith Trigg and Mr. Jonathan White from the Imperial War Museum in Duxford, England.

The U.S. Air Force Museum acquired the World War II aircraft from the Imperial War Museum. The three British restoration officials remained for two weeks to work with the museum restoration staff in preparing the Spitfire for

display.

A C-141C Starlifter belonging to the Air Force Reserve 445th Airlift Wing here brought the Spitfire to the base from the Royal Air Force Base at Mildenhall, England. The Spitfire made the trek to the museum's restoration hangar on a flatbed from the wing's flight line.

Initially, the aircraft will be placed in the Early Years gallery and will bear standard Royal Air Force (RAF) colors with markings to reflect combat action such aircraft when American volunteer pilots flew them in the RAF's Eagle Squadrons in 1942.

Eventually, restoration staff will repaint the fighter to represent Spitfires flown by the United States Army Air Corp's 31st and 52nd Fighter Groups during Operation Torch, the invasion of North Africa in November 1942.

— USAF Museum Public Affairs

## DiBattiste: Air Force facing retention crisis

ROBINS AIR FORCE BASE, Ga. — Air Force Undersecretary Carol DiBattiste visited here March 24 and said the U.S. Air Force has become the "service of choice for implementing national security," but faces a crisis in retaining and recruiting personnel.

Ms. DiBattiste made the remarks at the Air Force Reserve Command's annual awards banquet at the Aviation Museum.

Earlier in the day, she visited Robins depot maintenance activity group and the 93rd Air Control Wing.

At the banquet, she praised the reserves' contribution to the total force, helping to make it the "finest aerospace force in the world. U.S. air power proved its effectiveness in the last 10 years in the Gulf War, Bosnia and Kosovo, while maintaining missions in Korea and the Persian Gulf."

The Air Force faces a challenge, however, in recruiting and retention, also affecting the reserves, which draws the majority of its recruits from prior active service members. "Since the active force has been downsized, that leaves less to recruit from," she said.

The Air Force is attempting to turn the problem around by increasing the number of recruiters and advertising on prime-time television, she said.

— Mr. Hal McKenzie, WR-ALC



# Global Hawk deploys for six-week exercise

The U.S. Air Force's Global Hawk Unmanned Aerial Vehicle (UAV) began a six-week deployment March 20 to the Air Armament Center, Eglin Air Force Base, Fla., to demonstrate its unique reconnaissance capabilities during two major exercises. As part of that deployment, Global Hawk flew its first flight along the East Coast, and first trans-Atlantic flight to Europe.

The two events were called Linked Seas 00 and Joint Task Force Exercise (JTFEX) 00-02. The first exercise involved joint and service warfighters, the North Atlantic Treaty Organization's Supreme Allied Command Atlantic and its regional command SOUTHLANT, and several NATO nations, among them Portugal. The second exercise was sponsored by U.S. Joint Forces Command.

In a related activity April 20, while enroute from Edwards Air Force Base, Calif., to Eglin, Global Hawk conducted demonstration operations for the U.S. Coast Guard along the Gulf Coast.

"These activities focused on exploring its capabilities to assist civilian agencies in counter-drug and contraband interdiction operations," said Lt. Col. Mike Trundy, deployment commander for the Global Hawk program Office of the Reconnaissance Systems Program Office at Wright-Patterson Air Force Base, Ohio.

### Graduation exercises

"These were really graduation exercises for the Global Hawk advanced concept technology demonstration," said Col. Trundy. "All three events were part of an ongoing military utility

assessment of the high altitude endurance UAV concept and technology, running through June 2000, to determine how U.S. military forces might use Global Hawk in the future."

During Linked Seas 00, Global Hawk provided direct support to amphibious operations in a NATO environment involving air-, sea-, sub-surface and land-based assets. "SOUTHLANT commanded this exercise, involving amphibious landings on the coast of Portugal, and maritime operations in the vicinity of the Madeira Islands," said Col. Trundy.

During JTFEX 00-02, Global Hawk provided direct support for the joint maritime mission of a Navy carrier battle group and an amphibious ready group (Marine expeditionary unit) in a land and sea environment.

### Flexible capabilities

"Global Hawk provided the joint force commander with flexible capability to acquire near real-time reconnaissance information at extended ranges and duration, in day or night, all-weather conditions," Col. Trundy said. "In an operationally realistic environment, we planned exercise-specific opportunities to demonstrate its unique imagery collection, processing and transmission skills to warfighters."

Exercise scenarios involved challenges by a mobile enemy operating in coastal areas, said Col. Trundy.

"Our intelligence, reconnaissance and surveillance objectives keyed on a rapid targeting cycle, during which Global Hawk demonstrated wide area search imagery for fleet defense; direct

support to amphibious operations; and special operations. The UAV provided continuous intelligence about battlespace; bomb and battle damage assessment; and time-sensitive targeting."

U.S. Joint Forces Command's Joint warfighting center in Suffolk, Va., serves as temporary home to the UAV's mission control element. The element normally located at Edwards, was airlifted to Langley Air Force Base, Va., April 4 by a C-141 assigned to the 62nd Airlift Wing at McChord Air Force Base, Wash.

The 46th Test Wing at Eglin supports Global Hawk's launch and recovery element. The element was airlifted there April 13 from prime contractor Northrop Grumman's Ryan Aeronautical Center in San Diego, Calif., via C-17 aircraft assigned to the 437th Airlift Wing, Charleston Air Force Base, S.C.

A developmental flight vehicle, Global Hawk will provide Air Force and joint-service commanders high-altitude, long-endurance battlefield reconnaissance imagery in near real-time.

When operational, Global Hawk will be able to fly at altitudes greater than 60,000 feet and remain on station for more than 24 hours.

The other contractors for Global Hawk are: Raytheon Systems, Falls Church, Va., Garland, Texas, and El Segundo, Calif. (ground segment and sensors); Rolls-Royce Allison, Indianapolis (turbofan engine); Boeing North American, Wichita, Kan. (carbon-fiber wing); L3 Com, Salt Lake City, Utah (communications systems).

— Ms. Sue Baker, ASC Public Affairs

# Swiss dragonfly makes a splash at Edwards

The U.S. Air Force Test Pilot School, Edwards Air Force Base, Calif., is testing a new concept in aircrew protection — a liquid-filled, full-body anti-gravity suit.

Testing of the Swiss “Libelle” anti-G suit is a collaborative effort by test pilot school, Air Combat Command’s (ACC) Humans Integration Division and the Air Expeditionary Force (AEF) Battlelab at Mountain Home Air Force Base, Idaho.

## Liquid force

Using hydrostatic (liquid) force to regulate suit pressure, the Libelle, which means dragonfly in Swiss, could prove better than current pneumatic (compressed air) anti-G suits.

During high-G acceleration forces, much of a pilot’s blood is pushed towards the body’s lower half. In just seconds, a shift in blood volume away from the brain can cause a blackout.

To fight such potentially deadly occurrences, Air Force fighter aircrews use pneumatic anti-G suits and the anti-G straining maneuver, said Capt. Aaron George, project pilot and team leader.

“G-induced loss of consciousness, is rare due to such countermeasures. However, high-G continues to impact aircrew performance and G-induced loss of consciousness has not been eliminated.”

## Prototype testing

That may change in the near future if the Test Pilot School’s latest endeavor proves fruitful, said project engineer Capt. Shon Williams. Working with Libelle’s developer — Mr. Andreas Reinhard from Life Support Systems — an Air Force team of three test pilots, three test engineers and a physiologist have begun testing the prototype suit at Edwards.

Life Support Systems and Mr. Reinhard have been developing the

Libelle concept via centrifuge and flight testing with Swiss and German air forces. The suit is based on a liquid concept that does not require mechanical regulating systems or on-board compressed air.

## Total protection

“Our goal is to provide total G protection for the pilot with a suit that

training and ground evaluations including egress training, hanging harness and cockpit interoperability checks in the T-38 Talon, as well as altitude chamber testing and multiple centrifuge runs. Because Libelle’s function is dramatically different from the current Combat Edge ensemble used by F-15 Eagle and F-16 Fighting Falcon aircrews, Test Pilot School aircrew underwent extensive

training wearing the suit in a Holloman centrifuge.

“The training we received at Holloman was superb,” Capt. George said. “We headquartered our operations at the base’s Physiological Training Flight, which became part of our team ... and essential to our success. We departed Holloman with a wealth of knowledge about how to operate effectively with the suit during flight tests.”

During the next few weeks, test pilot school students will flight-test the suit in both the T-38 and F-16 at



**Capt. Aaron George, team leader for the Libelle anti-G suit test, climbs out of an Edwards Air Force Base, Calif., T-38 Talon after completing the first U.S. flight with the Swiss-made anti-gravity suit.**

can hardly be felt,” Mr. Reinhard said.

The AEF Battlelab learned of the suit through a suggestion by Col. Pete Demitry, director of the ACC Human Systems Integration Division.

In February, a battlelab initiative entitled “Self-regulating Anti-G Ensemble” was begun to demonstrate Libelle technology. The Swiss suit’s potential advantages: reduced need for positive-pressure breathing, reduced physical effort, improved ability to communicate under high-G conditions and elimination of the G-valve.

“One of Libelle’s most valuable attributes may be its ability to function independently, eliminating the need for a G-valve or hose connection,” said Lt. Col. Don Diesel, AEF Battlelab initiative team leader.

Before beginning testing here, the Libelle team traveled to Holloman Air Force Base, N.M., for a week of

Edwards.

The next stage here for the AEF Battlelab initiative: a more extensive look at the Libelle ensemble this summer under hot environmental conditions. The initiative also will assess the Libelle with regard to projected cost verses benefit of supply, logistics, maintenance, training and safety.

## Self-regulating

A final report by the AEF Battlelab on the self-regulating anti-G ensemble concept demonstration is expected in August.

“We plan to complete the concept demonstration by this summer, and based upon our findings, make recommendations on the technology to senior Air Force leaders and the acquisition community,” Lt. Col. Diesel said.

— Information supplied by AFFTC Public Affairs

# Over the hump

## ***C-5 team at halfway point on A-model tie-box repairs***

The C-5 Maintenance Directorate at Robins Air Force Base, Ga., recently turned the corner in fixing severe cracks in the tail section of the giant C-5A cargo plane that had the potential to ground the entire fleet of 76 A-model aircraft.

Project and production planner Mr. Andres De La Rosa Jr. marked the occasion in an e-mail he sent to the team on March 16 including comments from Systems Program Directorate engineer Capt. Robert Pittman.

"Congratulations, team! We're over the hump — 38 of 76 horizontal stabilizer tie box fittings have been replaced. Keep up the good work," Capt. Pittman wrote.

The problem cropped up in January 1998 when the first C-5A undergoing periodic depot maintenance at Kelly Air Force Base, Texas, showed severe cracks in the horizontal stabilizer tie-box, a key structural fitting that reinforces the wing-like structure to the 65-foot-tall tail.

Immediate detailed inspections of all C-5As and later C-5Bs undergoing maintenance at Robins and at the Lockheed Martin plant in Marietta, Ga., revealed similar cracks in six of seven

C-5As inspected. The problem did not show up in the newer B models.

"When that occurred, that had the potential to ground the whole fleet," said C-5 Maintenance Program Directorate Manager Mr. Refugio "Ray" Rios.

In cooperation with the contractor, "We put together a specialized team and learned how to remove and replace the tie-box. It took a couple of trips to Lockheed and required our engineers to design the support fittings to hold up the whole structure."

"Basically it's the same box, just different material, a little bit more stress- and corrosion-resistant," said project engineer Mr. John Lafitte. "It gives the aircraft a new lease on life."

A prototype team of sheet metal technicians "validated the process and allowed the full production run," Mr. Rios said, while Mr. De La Rosa "took

the lead in developing the step-by-step procedures and documents." After the first prototype verification, they started the full tie box repair production run in September 1999.

"We've been able to replace the tie boxes and get them to the field on a timely basis to support the mission without flight restrictions," Mr. Rios said. A turnaround time of 56 days for the repair was reduced to about 46 days.

"We've completed 13 boxes here at Robins. We have three more in progress and four remaining in the FY00 schedule," Mr. Lafitte said. The rest of the fleet is being repaired at Lockheed Martin in Marietta.

Repairs extend the lifetime of the C-5As, which average 30 years old. "There are no flight restrictions at all [on the repaired planes]," said Mr. De La Rosa. "They're good for another 30 years."

*Mr. Hal McKenzie, WR-ALC Public Affairs*



## **Titan rocket tested at Edwards**

A Titan IV solid rocket motor upgrade booster using new nozzle material was successfully test fired at Edwards Air Force Base, Calif., March 19.

The booster's static test firing took place on the Air Force Research Laboratory's Test Stand 1-C overlooking a massive dry lakebed at Edwards. This is the latest validation test for the Titan IV space launch program managed by Space and Missile Systems Center at Los Angeles Air Force Base, El Segundo, Calif.

Lasting 140 seconds, the test generated 1.7 million pounds of thrust. The 11-story high, three-segment solid rocket booster, weighing approximately 750,000 pounds, was filled with solid rocket propellant.

The Titan IV rocket was developed to enhance performance of the nation's largest heavy-lift space launch vehicle. It has increased the Titan IV system's lift capability by 25 percent while improving its reliability. This test provides the program with full system data to validate new materials used in manufacturing the rocket's enhanced carbon-carbon nozzle.

These new materials are manufactured in an environmentally sound manner replacing materials that were no longer compliant or available under current environmental regulations.

The Titan's last test on Stand 1-C was in late 1993, completing a successful series of five validation tests over a wide range of operating temperatures.

— AFFTC report

# When you care enough to send the very best

**A**s an engineering data technician working with blueprints and customers all over the world, Mr. Nick Nicholson is a man who loves his work in the Technology and Industrial Support Directorate at Tinker Air Force Base, Okla.

Mr. Nicholson is also a sketch artist who creates his own greeting cards for his co-workers, bringing a little light into a building with few windows.

## Love of art

Mr. Nicholson has been an employee at Tinker for more than 30 years. Beyond his career and before his enlistment in Vietnam, back to his grade school days, he nurtured and developed his love for art. His works are not featured in museums, but the finest cubicles in his branch. He thinks gallery showings and money aren't as motivating as sharing with friends and co-workers.

"I enjoy giving people a boost," said Mr. Nicholson. "I just started creating cards for my entire office last year, but I've been making cards for my friends a few years now. I saw a hole in greeting card selections, most being too adult or too impersonal. I wanted to do something different, something special to lift morale in my office."

## Beyond words

What Mr. Nicholson does with his cards goes beyond words. He draws by hand intricate sketches and caricatures: all of them done at home after hours, many done over the course of several nights. Creating a variety of Valentine cards for his office, required a month's worth of evenings and weekends.

Creating one card could involve using a variety of different media. Mr. Nicholson can use watercolors, inks and pencils. He says the gift of giving each card is only one reward.

## Thought process

"Art helps you out in almost every aspect of life," he said. "Whenever you're about to tackle a project or do anything, you do a thought process. People usually write or draw things before they implement an action. In every endeavor I can think of involving any degree of complexity, the ability to see things abstractly helps one be a better, effective planner."

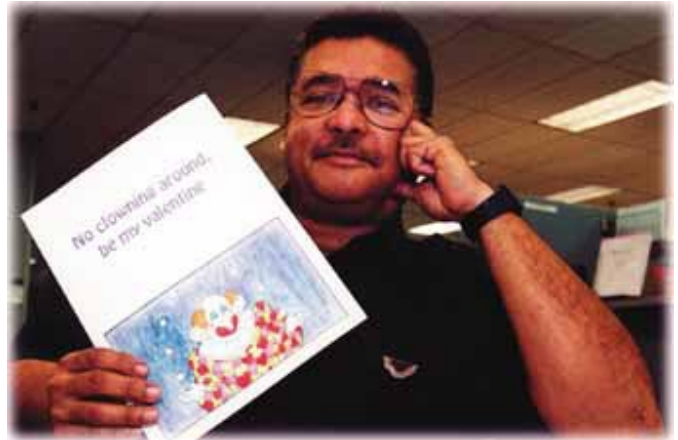
Mr. Nicholson works with blueprints every day and his eyes see all sorts of details and complexities. Having a father and grandfather who both drew as a hobby also helped nurture Mr. Nicholson's eye for art.

## Not for profit

New works by Mr. Nicholson are not sold, nor does he ever plan to do it for profit. It's not work, he said, and it never will be. It is something that makes him feel good, and when he talks to a co-worker and discovers she has kept one of his cards for more than 20 years, that makes him feel great.

Most of Mr. Nicholson's art is personal, and some of it is political and religious in nature. Not every work reaches its intended audience either, but he said he feels a great thrill when people see his art and know what he's trying to say.

"I always tell people that even if they feel like they don't have the skill, they really do," he said. "Some of the best cartoons I've seen have been stick figures and they're using a



Ms. Margo Wright, OC-ALC

**Mr. Nick Nicholson, Technology and Industrial Support Directorate, Tinker Air Force Base, Okla., spends his free time creating hand-drawn greeting cards. He made personalized cards for every person in his office for Valentine's Day.**



technical ability to convey their point. There is art in there. What you have to do is look for the art in life and embellish it. Art is everywhere you go. The effort to draw art out can be as important as the ability to do so."

## It's a gift

Mr. Nicholson's works have gained support and recognition from his co-workers, who see him as "a man with a gift." Mr. Joe Morrison, another engineering data technician, said he is always amazed at the beauty within his co-worker's drawings.

"Getting a card like this makes one feel really special," Mr. Morrison said. "He even puts a special statement in each card to further personalize it, something that reflects the recipient or some element of their life. These are works of art and he makes them just for us. It's incredible."

But there is one message understood in every work Mr. Nicholson does for his co-workers: he appreciates them and thinks they're worth a little extra effort. If building a strong bond with one's peers can be called an art, then there is an artist here who is making masterpieces.

— Mr. Andy Stephens, WR-ALC Public Affairs

# Former Brooks pilot receives Purple Heart

Nearly blind, but strikingly fit in his Air Force uniform last worn 34 years ago, former Brooks Field pilot, retired Maj. Richard Anderson was gently guided to his place of honor. A survivor of both the Pearl Harbor attack and the D-Day invasion, the 77-year-old veteran ended his 55-plus year wait for the nation's oldest military decoration — the Purple Heart.

In a ceremony held Feb. 18 at the U.S. Air Force School of Aerospace Medicine, Maj. Anderson received the medal for wounds he suffered during World War II.

## Heroes

"He is one of my personal heroes," said Col. Steve Harman, former head of the 311th Human Systems Program Office director. Now Electronics Warfare Directorate director at Edwards Air Force Base, Calif., Col. Harman presented the medal to a long-time family friend.

"I really don't feel like a hero. The real heroes are my friend [Eugene] that I lost, and his shipmates," Maj. Anderson said.

Richard Anderson and Eugene Whitcomb did not know in November 1940 that fate would intervene when they enlisted in their hometown of Homer, Mich. They would be reunited for a year while stationed in Hawaii. Pvt. Whitcomb served as an electrician's mate aboard the U.S.S. Arizona.

Then Pvt. Anderson was an operations and engineer clerk for the 23rd Bomb Squadron at Hickam Field. The 19-year-old Army Air Corps private often slept overnight on the Arizona to be with Pvt. Whitcomb.

They would see each other for the last time on Dec. 6, 1941. Pvt. Anderson, accustomed to his friend's lifelong knack for premonitions, knew something was bothering his friend after they saw the movie "*A Yank in the R.A.F.*"

"It won't be long before we're going to do what we saw tonight," said Pvt. Whitcomb. "Before I left home I had a disagreement with my folks. I want you to apologize to them for me." Pvt.

Anderson's reply "You tell them yourself" elicited an ominous response: "I won't survive the war, but you will."

## Pearl Harbor attack

At 6:55 the next morning, Pvt. Anderson was jolted from his bunk by an explosion he initially mistook for a ruptured petroleum storage tank. "I went back to bed. No sooner did my head hit

died on the Arizona. "I was hoping he had survived it," he said, noting that Eugene's death piqued his lifelong resolve to become a pilot.

In a letter to his parents dated Dec. 19, 1941, he wrote: "Eugene wasn't among the dead so there likely wasn't enough left of him to find. That's why I've got to get to be a pilot. Those guys are going to pay heavy for what they did to Eugene."

## D-Day

Anderson then became a B-24 pilot and was stationed in Italy. During his first combat mission, his face was pulverized by flying glass when German anti-aircraft fire shattered the cockpit window. He was seriously injured on his 19th and final mission on D-Day, June 6, 1944, one day before his 22nd birthday.

"We were on a mission to bomb submarine pens and troop concentrations in southern France," said Maj. Anderson. Enemy fire knocked out one engine and crippled a second. The remaining

two engines eventually failed. "We crashed about 70 miles southwest of Bari [Italy]."

One crewman was killed and Maj. Anderson was partially paralyzed. He spent nine months in military hospitals. Maj. Anderson, who served at Brooks Air Force Base, Texas, during the Korean War, retired from the Air Force in 1966.

Maj. Anderson never sought medals for his WWII service until his daughters Sharon and Sandra intervened ten years ago. Despite his military records being destroyed in a fire, his family eventually prevailed with the help of U.S. Sen. Kay Bailey Hutchinson (R-Texas).

Months before Maj. Anderson received his medal, Col. Harman arranged for copies of the Purple Heart certificate to be flown on a B-1, B-2 and B-52 from Edwards Air Force Base, Calif., 412th Test Wing as a fitting tribute to a former bomber pilot who had once trained there.

— Mr. Rudy Purificato, AFRL



Ssgt. Bradon Kavanaugh, AFRL

**Col. Steve Harman pins the Purple Heart medal on WWII pilot Maj. Richard Anderson in a ceremony held Feb. 18 at the U.S. Air Force School of Aerospace Medicine, Brooks Air Force Base, Texas.**

the pillow than I heard machine gun fire. I jumped up and looked out the window as a Japanese Zero flew by," he said.

Wearing only shorts, he bolted outside to see a horrendous sight: enemy planes strafing troops as they left their barracks. "I ran back into my barracks to dress, and headed for Hangar 5." Seconds later, a bomb destroyed his barracks.

Meanwhile, Pvt. Anderson and about a dozen unit members had armed themselves with the only weapons available to them: 45-caliber revolvers.

"We stood firing out on the lawn in front of the hangar. I don't think we hit any of them but it helped us to release the tension. We felt we had to do something to defend ourselves."

They battled two waves of planes during successive attacks that lasted for more than 20 minutes. Following the attack, Pvt. Anderson's thoughts were focused on Eugene. After not finding his friend among burn victims at the naval hospital, he knew Eugene had



# ROSIE the RIVETER

**M**ore than a hundred “Rosies” watched the unveiling of a bronze bust of “Rosie the Riveter” March 23 at the Tinker Air Force Base, Okla., Officers’ Club.

The statue commemorates the female work force during World War II and women through the ages as Rosie takes her place as a permanent exhibit in the Tinker Heritage Airpark.

## Called to duty

It’s believed by many that advertisers first used the term “Rosie the Riveter” during World War II in a campaign encouraging a female work force to replace the men at war.

Rosie came to represent all the women who worked in hundreds of different capacities to keep the nation running while they continued to raise their children.

Tinker installation commander Maj. Gen. Michael Zettler was one of these children. “When my dad went off to war, my mother had been working for about 15 years in a dairy,” he said during the dedication ceremony.

“She could have stayed in the dairy, but she wanted to do something different. She went down to the Wright Plant in Ohio and got a job the same day building aircraft engines. Mom started out etching serial numbers on parts and worked her way through other tasks. Then she transferred to the Bendix Plant, which was only two miles from the house, and built carburetors for aircraft engines.

“The message I got was how important every person in America was to the effort that kept America running in our crusade to preserve the freedom we have today. It was a national effort, but it was one that every one of you made a difference. We needed to do this today because we need to preserve this piece of our history for all of our children. It took the full nation, all citizenry back then to do the task, and it takes all of our people today to do the task. Every one of us, men and women, recognizes the contributions you made to make America great.”

## Doing what needed to be done

Mrs. Frankie Collier, a retired inspection clerk who worked at the Douglas Plant in 1944, was just such a woman who came to the aid of the nation when it called.

“During World War II, we worked at desks, we drove forklifts, we lifted loads and we riveted,” she said. “Elsewhere in the country, women drove taxis, delivered mail, farmed and even worked on cars, whatever needed to be done, because it needed to be done.

“In August of 1944, the day I became 18 years old, I filed for a job at the Douglas Aircraft Company,” said Mrs. Collier. “I had no idea I would be pioneering the way for women in the future, but proud of the role I played in the changing of our culture in our country.”

Women proved they could do the job, and do it well, said Mrs. Collier.

“There was almost no limit to what we could accomplish when we rolled up our sleeves and set our minds to it. It’s hard for me to think of myself as a pioneer because our country asked for our help and we were there to give it without question. But it did teach me one thing: women can do anything they set their minds to. I’d like to encourage the women of today to forge ahead to their dreams,” she said.

## Providing services

Oklahoma’s lieutenant governor, Ms. Mary Fallin, congratulated the Rosies on their service. “You were doing what I consider the first cause we have — service to our country and service to our families in defending our nation to ensure we have the freedom we all deserve and want so much.

“When the call went out for women to enter the work force, it was so successful that more than 18 million women came into the work force,” said Ms. Fallin.

“Now we work side by side with our male counterparts. Since the Rosie the Riveter symbolism and the call to duty, there are over 200,000 women business owners in the state of Oklahoma and one out of every four jobs is created by a woman. Because of those women who came before us, we’ve seen a direct impact.”

In the military today, more than 1,400 women fly fixed-wing aircraft and helicopters, said Ms. Fallin. “The top pilot in the world for [commercial] airlines is a woman,” she said.

“In Congress, out of 323 executive posts, 91 are held by women. The presidential cabinet has 21 women and 21 percent of all of our cities in the United States are run by women mayors. So the Rosies truly paved the way for us. As this statue of Rosie stands in the Tinker Airpark, I hope our men and women, and especially our children, look at the statue and are reminded of the time the women took up the challenge to help their country and pave the way.”

Ms. Fallin then read a proclamation from Gov. Frank Keating proclaiming March 23 as Rosie the Riveter day in Oklahoma.

— Ms. Gail Kulhavy, OC-ALC Public Affairs

# 'Strong wind' blows exercise off base

**A**eronautical Systems Center (ASC), Wright-Patterson Air Force Base, Ohio's, Strongwind 00-1 exercise April 1 wasn't run-of-the-mill. It included a deployment of troops, natural disaster and major accident. But this time the airplane crash happened Saturday morning, instead of on a weekday, which most Wright-Patterson people are used to.

"Having a weekend exercise, you don't have to contend with day-to-day activities," said Col. Roy Taylor, ASC inspector general. "However, you have to recall people because they're not in the office."

Between 8:30 a.m. and 3 p.m. in a field outside Enon, the major accident response exercise tested how Wright-Patterson emergency crews and civil authorities manage when an aircraft crashes.



**1st Lt. Jennifer Riedel takes a water sample from a lake. Lt. Riedel's team used a portable field laboratory to test the water for contaminants.**



*Photos by Mr. Spencer Lane, ASC*

**Tech. Sgt. Jesse Howard, 356th Airlift Squadron, wanders through the "crash site" as he plays the role of a crash survivor.**

Firefighters, police and emergency medical technicians representing Enon-Mad River and Bethel townships worked with base officials on the scene, which was littered with aircraft parts, people with simulated injuries, and debris.

"Civilians don't get a chance to see how we conduct exercises," Col. Taylor said. "We normally don't get them involved. In this case, we initially supported them. They wanted to see our capabilities."

"It was a good learning experience, and we were able to meet our objectives: learn and practice," Col. Taylor said.

Senior Airman Shawn Guffey, 74th Aerospace Medical Squadron Bioenvironmental Engineering Flight, removed the air-tight chemical suit he wore for 45 minutes while checking air conditions in the accident zone.

"It's good practice," Airman Guffey said of the Saturday scenario. "It gives it more of a real-world feel."

Civilian employees are generally more accustomed to being at home on weekends than practicing real-world jobs on-scene.

"With work-day exercises, everything happens within duty hours," said Ms. Treva Bashore, 88th Air Base Wing Environmental Management. "This was more real-world, because emergencies don't only happen nine-to-five. We have families to contend with."

Mr. Tim Clendenin of environmental management was missing his Saturday morning run to the doughnut shop for his family.

"You do what you have to do," he said. "This is what we do. We've got to be ready for it."

— SSgt. Stuart Camp, ASC Public Affairs

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# Who let the dogs out?

## Hill represents AFMC at Readiness Challenge VII

Readiness Challenge VII (RC VII) started with a “bang” as a ground-burst simulator signaled teams from Canada, Great Britain and Air Force bases around the world into competition. Fighting for top honors in what could be called the Olympics for civil engineers, Services and chaplain services personnel; 12 teams went head-to-head in one of 47 events comprising RC VII, a competition held at Tyndall Air Force Base, Fla., every two years.

Hill Air Force Base, Utah, augmented by a chaplain and chaplain’s assistant from Eglin Air Force Base, Fla., represented AFMC, at the April 30 through May 4 competition.

“This is an opportunity to showcase the Air Force’s best base support people while providing training, encouraging teamwork and promoting esprit de corps,” said Chief Master Sgt. Dave Force, AFMC team non-commissioned officer in charge. “It is also a chance to work with other nations that we may have to fight beside someday.”

Desert Storm halted all training for teams preparing for a Readiness Challenge competition in 1990. Many of the competitors then deployed to the Gulf

region in support of the successful air campaign against Iraq. Last year, the competition was cancelled just 10 days before its start because of operations in Kosovo.

The competition, five days of grueling events, encompasses different contingency events from installing a mobile kitchen trailer to extinguishing an aircraft fire. Events are timed and penalty points given to teams that do not complete their mission correctly.

“People are expected to push themselves to the maximum, physically and mentally, and then reach for more,” said Capt. Doug Brown, officer in charge, AFMC team. “It was exhausting, but our team was ready for the challenge.”

The team, 32 members strong, was comprised of utility specialists; explosive ordinance disposal technicians; firefighters; electricians; heating, ventilation and air conditioning specialists; disaster preparedness officials; engineering assistants; heavy equipment operators; structures personnel; power production personnel; Services personnel, and a chaplain and chaplain’s assistant.



“Our additional training may seem unnecessary to people who don’t understand what the competition is all about,” said Capt. Brown.

“The bottom line is that the Air Force is tasking nearly 400 base support personnel to hone their contingency skills and then demonstrate their ability to execute their wartime missions.”

These people will form a core of highly skilled airmen who go back to their home bases and share

with their units the knowledge and skills they have gained during the competition. In the end, the Air Force’s overall capabilities to deploy and conduct contingency operations will be strengthened, he said.

During competition, AFMC’s chant, “Who let the dogs out?” encouraged team members to give just a little bit more and try a little harder. “It always worked,” said Chief Force.

“Just the time you wanted to

stop, the team would start yelling ‘who let the dogs out?’ It helped you keep going.”

Two international teams sponsored events this year. Great Britain sponsored the Harrier Hide and Canada brought Aircraft Decoy. American teams, given only instructions and a video, had to complete the events for the first time during the competition.

“We competed well in the international events,” said Chief Force. “They were a lot of fun and





## Services sergeant has animal instincts

"Help me rip my shirt off."

Staff Sgt. Jeremy Kell's voice was calm but held a sense of urgency. It took a few seconds for his teammates, focused on the hardback competition, to hear Sgt. Kell's call for help.

"I was cutting plywood and I looked over and saw him [Sgt. Kell] trying to tear his shirt off," said Tech. Sgt. Jim Segler. "I was torn between helping and continuing my job."

Unknown to his team, Sgt. Kell was losing a potentially dangerous amount of blood from where his saw slipped and slashed his arm. Three teammates rushed to him and tore the shirt off his back as a dressing.

"From that point on, I tried to concentrate on cutting the wood, but all I could think about was Jeremy," said Sgt. Segler. "It was easier to get back to work once he came back in. I knew if they [medics] could patch him up he would be back in."

Sgt. Kell was sawing two-by-fours when the saw bowed and cut into his forearm. "I was on a downward stroke when it happened. It came down on my arm instead and skipped across it."

Six, 1-inch lacerations required 14 stitches. But not before Sgt. Kell finished the hardback competition and then followed that to compete in the Camouflage, Concealment and Deception event.

"The medics told me that if they saw any blood come through the bandage, they would pull me out," said Sgt. Kell. "I just kept telling them to hurry up so I could get back in."

"Self-Aid and Buddy Care is not a popular topic," said Staff Sgt. T.J. Nunn, Hill Warrior's Self-Aid/Buddy Care instructor. "But Jeremy's a prime example of its importance. His quick thinking lessened the wound's severity and got him back in the game."

"I'm just in awe," said Sgt. Segler. "He was a regular Services guy and when he joined the team and then he became an animal. He won't back down when you present him a challenge. He'll kick it and look for another."

It was an emotional Sgt. Kell who finished the hardback competition, not because of the pain, but because of the job well done by his team. "We did it, guys."

— 1st Lt. CK Keegan, AFMC Public Affairs



**Staff Sgt. Jeremy Kell cuts wood during the harback competition.**

really tested your ability to take information from a piece of paper, work together as a team to determine the best way to do the job and then see it actually work."

Japan and Norway had small teams that participated in a few events. Service members from France, Greece, the Republic of Korea and Italy observed this year for possible participation in the future.

AFMC took second place in Camouflage, Concealment and

Deception; covering a hardback which include installing a heater; and the airfield event (comprised of four separate events). The team won third place in immersion heater and hardback construction and tied for third in the M-16 competition and Harrier Hide.

They placed eighth overall, separated from the first-place team by a mere 49 points.

— 1st Lt. CK Keegan, AFMC Public Affairs

**Top left to right: Staff Sgt. Nelson Kendall crawls under barbed wire in a practice obstacle course at Eglin Air Force Base, Fla. Staff Sgt. Chris Parker pulls a dummy out of a smoky building in the Ventilation and Rescue event. Part of remains processing, Senior Airman Emil Graves fingerprints a simulated corpse.**

**Bottom left to right: Master Sgt. Jeff Clouse and Tech. Sgt. Jim Segler hammer metal stakes in the ground, to set up part of an arresting system. Tech. Sgt. Mike Gribble (foreground) shows Airman 1st Class J.T. Biberston where his 50-caliber shots are on the target. Staff Sgt. Bill Miller navigates the monkey bars in the obstacle course.**

